Chapter 1

Introduction

1.1 Background

Viral infections, including influenza infections, are the most common cause of diseases worldwide (Dronina et al., 2021). Influenza A Virus (IAV) is a type of influenza virus that causes influenza, which is an acute viral infection of the upper and lower respiratory tract (Świerczyńska et al., 2022). Influenza is extremely contagious as it is able to be transmitted directly from person-to-person via airborne transmission through contaminated air droplets as well as indirect transmission as IAV is able to remain viable on 27.8–28.3°C for 48 hours on hard surfaces (Le Sage et al., 2023; Wißmann et al., 2021). Influenza causes an estimated 3 to 5 million severe infection cases with 291,000 to 646,000 deaths worldwide every year, with the majority of these cases occurring in low-income countries (Lafond et al., 2021). In Indonesia, an outbreak of IAV occurred in Riau Islands in 2009 and caused approximately 50% of severe acute respiratory infections by June 2024 (Sarah et al., 2023; World Health Organization [WHO], 2024).

Several influenza treatments have been developed over the years, including amantadine, oseltamivir and zanamivir. However, the administration of certain types of influenza treatments presents challenges, and the effective distribution of these drugs to remote areas, particularly in Indonesia, remains to be a significant challenge (National Academy of Medicine et al., 2021; Afriani et al., 2022). Therefore, alternative treatments have been researched that utilizes commonly available local resources, including herbal medicines that are derived from plants of the genus *Curcuma* (Xiong et al., 2020; Choi et al., 2020; Nishidono et al., 2020).

Curcuma heyneana (temu giring) is a native Indonesian plant that is widely used as spices as well as traditional herbal medicines, particularly in Java and Bali (Siregar et al., 2023; Fajrin et al., 2023).

Recent studies have found active compounds that express antimicrobial activity in *C. heyneana*, including α-zingiberene, α-terpinolene, ar-turmerone, β-turmerone, 1,8-cineole, camphor, curcumin, and heyneanone. Furthermore, *C. heyneana* also has the most abundant amount of demethoxycurcumin, a type of curcuminoid, compared to other *Curcuma* species (Nurjamil et al., 2023; Septama et al., 2023; Wardana et al., 2024; Santoso et al., 2024; Cui et al., 2024). Therefore, *C. heyneana* is further researched to investigate its antimicrobial properties as a potentially accessible treatment for influenza in Indonesia.

1.2 Objective

The main objective of this research is:

- To investigate the potential antiviral activity of *C. heyneana* against IAV in A549 cells by evaluating the effects of *C. heyneana* treatment on cell viability through CPE analysis and gene expression study of *M, IL6,* and *TNF* genes of the IAV-infected A549 cells.

1.3 Hypothesis

Based on this research, the hypotheses are:

- H_0 : *C. heyneana* is not able to suppress the CPE and expression of *M, IL6,* and *TNF* genes of the IAV-infected A549 cells.
- H_1 : *C. heyneana* is able to suppress the CPE and expression of *M, IL6,* and *TNF* genes of the IAV-infected A549 cells.